Revista Electrónica de Biomedicina
Electronic Journal of Biomedicine

ISSN: 1697-090X



## Letters to the Editor / Cartas al Editor

# BLOOD GROUP, GENOTYPE, HANDEDNESS, AND INTERLOCKING FINGER TRAITS COMBINATION PATTERN AMONGST THE POPULATION OF EKPOMA - NIGERIA

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Rev Electron Biomed / Electron J Biomed 2009;3:65-72.

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**To the Editor:**

**Amongst the population of the world, genotypes (AA, AS or SS) vary and this is same for blood groups (A, B, AB, and O/ *Rhesus* factor [$Rh^+$ and $Rh^-$])[1-7] as well as the interlocking finger pattern (with either a right or left thumb on top) seen when both hands are clasped8. Existing scientific evidence has shown that the ABO and Rh blood groups are among the most important blood group systems1 and it was the description of the ABO blood group system in 1900 by Karl Landsteiner, that signaled the beginning of blood banking and transfusion medicine[9].**

**On the other hand, there has been a considerable interest in the contribution of inheritance to the determination of handedness and the associations between hand laterality and twinning as well as gender and age. Quoting Morley and Caffrey[10], "an unpublished data from a study of children born preterm suggested that there is an association between ABO blood group and handedness". They added however, that from the outcome of a questionnaire filled in by 3815 blood donors who gave information on blood group, age, gender, twins (or not) and hand preference, "there was no association between ABO blood group or *Rhesus* group and handedness".**

**Despite these varied opinion on the association between handedness and blood groups, Flatt[11], in his most revealing article, showed how a variety of disciplines have examined the relationship of left-handedness to health conditions such as allergies, auditory hallucinations, autoimmune disease, birth complications and prematurity, cancer, childhood behavioral abnormalities, childhood cognitive disorders, circulatory disease, coronary disease, Crohn's disease, dyslexia, eczema, epilepsy in parents, head trauma, hormonal imbalances, immune disorders, learning disorders, migraines and tension headaches, myasthenia gravis, psychoses, reproductive problems, rotational fractures of the tibia, stammering and stuttering, stress-related problems, twinning, and ulcerative colitis, as well as injuries and accidents and factors such as alcohol consumption, cigarette smoking, homosexuality, and criminality.**

**Indeed, population diversity provides a unique opportunity to study the morphogenetic variations amongst the endogamous populations living in different geographical and ecological conditions of the world[12]. Of course, marked inter-individual variability in genetic and non-genetic factors has been said to posses that ability to influence the disposition of many endobiotics and xenobiotics affecting health[13]. Although, Das and Sengupta[3] states that genetic mechanisms on morphogenetic traits is still not clearly understood as it is seen to occur with variable frequency in different populations, they agreed however, that it is a useful tool in evaluating and analysing evolutionary forces and classification as well.**

**In fact, scientists on one hand, are beginning to understand how genes interact with each other and with environmental factors in ways that impact on health[14] while on the other, there is a growing sense in genetic epidemiology that many findings are failing to replicate, because many of the claimed associations are false positive and these false positives are seen because of our inability to study many genetic variants in relation to many disease outcomes without knowing the precise bio-cultural background of the groups being studied[15-16].**

**Therefore, this study on the ABO blood groups, *Rhesus* factor, handedness, and interlocking finger combination pattern, is one in the series of several preliminary attempts to determine the possible morphogenetic traits combination pattern amongst the population of Ekpoma in South-South Nigeria, with the hope that the findings and documentations might in the nearest future, be of clinical relevance.**

**Study Area and Population**

**This study was carried out in Ekpoma, the administrative headquarters of Esan West local government area of Edo State, South-South Nigeria. It is the host community of the state owned Ambrose Alli University, and lies between latitude 60 40°N/60 45°N and longitude 60 05°E/60 10°E [17].**

**Geographically, Ekpoma is bounded on the South by Igueben local government area; on the Northwest and North East, by Owan East and Etsako West local government areas respectively; on the West, by Uhunmwode local government area; and on the East, by Esan Central local government area. The indigenes of Ekpoma speak the language known as 'Esan' and are predominantly farmers whose main produce are Rice and Cassava.**

**However, the study population comprised of one hundred and ninety three men and women (193) who were randomly selected amongst the indigenes and non-indigene residents of Ekpoma. Data/Sample Collection**

**Relying on informed consent, blood samples were obtained from the study population who were willing to know their blood group and genotype status. Blood sample collections were by veni-puncture using disposable syringes and then stored temporarily in refrigerated heparanised containers pending when laboratory determination of genotype and blood group types commences. The hand preference and interlocking finger patterns of the study population were determined via physical examination.**

**Sample Analysis**

**The laboratory analysis of the blood samples collected from the study population was done at Blossom Medical Laboratory, Uromi, Edo State in South-South Nigeria. The materials used for the laboratory analysis includes cellulose filter paper, distilled water, clean white tile, cotton wool, hand gloves, sterile rod, an electrophoresis machine and Tank, Tris buffer, normal saline, applicator stick, test tube, bucket centrifuge, AS/AA controls, and a pencil.**

**For the heamoglobin genotype test, the cells were washed 2 to 3 times in a test tube containing normal saline after which a drop of the washed cells was placed on a tile. This is followed by the haemolysis of the blood on the tile and the placement of the AS and AA control. With an applicator stick, the controls AA test and control AS in that order were placed on a cellulose acetate paper. After making sure that the Tris buffer inside the electrophoresis tank covered the electrode, the cellulose acetate paper carrying the test and controls was then placed in the tank. At this point, the tank is covered and the mains (current) switched on. After 5 - 10 minutes, the reading was taken and recorded.**

**For the blood group and *Rhesus* (Rh) test, the tile technique was used. This was done by preparing a 10% cell suspension followed by the addition of one volume of cells and sera. This was then mixed well and the tile rocked. The mixing process was performed with the aid of a wooden stick rocker. After 5 minutes, the reading was taken and recorded.**

**The result of this study show that majority of the population (112; 52.03%) have an interlocking finger with right thumb on top, while a relatively lower percentage of the population (81; 41.97%) have an interlocking finger with left thumb on top. A higher percentage of the population (176; 91.19%) was right handed while a relatively lower percentage of the population (9; 4.66%) and (8; 4.15) was left handed and ambidextrous respectively. The result showed also that a higher percentage of the population (123; 63.73%) was in the class of individuals with blood group O, while those with blood group A, B and AB numbered 34 (17.62%), 32 (16.58%) and 4 (2.07%) respectively. Similarly, a higher percentage of the population (188; 97.41%) was *Rhesus* positive while a lower percentage of the population (5; 2.59%) was *Rhesus* negative (Table 1).**

**Table 1: Distribution of morphogenetic traits amongst the population under study**

| Morphogenetic traits | | Number | Percentage (%) |
|---|---|---|---|
| Blood Group | A | 34 | 17.62 |
| | B | 32 | 16.58 |
| | AB | 4 | 2.07 |
| | O | 123 | 63.73 |
| | **Total** | **193** | **100** |
| Genotype | AA | 145 | 75.13 |
| | AS | 48 | 24.87 |
| | SS | 0 | 0 |
| | **Total** | **193** | **100** |
| *Rhesus* factor | Positive | 188 | 97.41 |
| | Negative | 5 | 2.59 |
| | **Total** | **193** | **100** |
| Interlocking Fingers | Right on Top | 112 | 52.03 |
| | Left on Top | 81 | 41.97 |
| | **Total** | **193** | **100** |
| Handedness | Right handed | 176 | 91.19 |
| | Left handed | 9 | 4.88 |
| | Ambidextrous | 8 | 4.15 |
| | **Total** | **193** | **100** |

**On the possible morphogenetic traits combination patterns, the study population were subdivided into different classes: (i) Interlocking finger (Right thumb on top; IFR) and Right Handed (HR) with either genotype AA or AS and with either blood type A, B, AB and O respectively; (ii) Interlocking finger (Left thumb on top; IFL) and Right Handed (HR) with either genotype AA or AS and with either blood type A, B, AB and O respectively; (iii) Interlocking finger (Right thumb on top; IFR) and Left Handed (HL) with either genotype AA or AS and with either blood type A, B, AB and O respectively; (iv) Interlocking finger (Left thumb on top; IFL) and Left Handed (HL) with either genotype AA or AS and with either blood type A, B, AB and O respectively; Interlocking finger (Right thumb on top; IFR) and Ambidextrous (HB) with either genotype AA or AS and with either blood type A, B, AB and O respectively; and Interlocking finger (Left thumb on top; IFL) and Ambidextrous (HB) with either genotype AA or AS and with either blood type A, B, AB and O respectively (table 2).**

**Table 2: Population size with different combination of traits**
**(Blood group, Genotype, Right handed, Left handed, or Ambidextrous and interlocking fingers with Right or Left thumb on top)**

| $A^+$ | | $A^-$ | | $B^+$ | | $B^-$ | | $AB^+$ | | $AB^-$ | | $O^+$ | | $O^-$ | | Blood Groups |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AA | AS | AA | AS | AA | AS | AA | AS | AA | AS | AA | AS | AA | AS | AA | AS | Genotypes |
| Individuals with different morphogenetic trait combinations | | | | | | | | | | | | | | | | Alternate traits combination pattern |
| 12 | 6 | 0 | 0 | 16 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 47 | 17 | 1 | 0 | IFR + HR |
| 8 | 4 | 1 | 1 | 8 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 32 | 11 | 2 | 0 | IFL + HR |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | IFR + HL |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | IFL + HL |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | IFR + HB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IFL + HB |

**Keys**: $A^+$, $A^-$, $B^+$, $B^-$, $AB^+$, $AB^-$, $O^+$, $O^-$ = Blood groups with *rhesus* positive and negative respectively;
IFR =Interlocking finger with right thumb on top; IFL =Interlocking finger with left thumb on top;
HR = Right handed; HL = Left handed; HB = Ambidextrous;

**We observed that there was none existence of the characteristic traits combinations: AA + IFR + HL+ $Rh^-$; AA + IFL + HL+ $Rh^-$; AA + IFR + HB+ $Rh^-$; AA + IFL + HB+ $Rh^-$; AS + IFR + HR + $Rh^-$; AS + IFR + HL+ $Rh^-$; AS + IFL + HL+ $Rh^-$; AS + IFR + HB+ $Rh^-$; and AS + IFL + HB+ $Rh^-$, irrespective of the blood group or genotype. Also, except for individuals with blood group O and genotype AA, none existence of the characteristic traits combination: AA + IFR + HR + $Rh^-$; AA + IFR + HL+ $Rh^+$; AA + IFL + HL+ $Rh^+$; AS + IFL + HL+ $Rh^+$; and AS + IFR + HB+ $Rh^+$, was observed.**

**Furthermore, individuals with characteristic traits combination: AS + IFL + HR + $Rh^-$ and AS + IFR + HL+ $Rh^+$, were observed only amongst those with blood group A and genotype AS in the ratio of 1:1. Also, individuals with the characteristic traits combination: AA + IFR + HB+ $Rh^+$, were observed only amongst those with blood group B and genotype AA . Similarly, individuals with the characteristic traits combination: IFL + HB+ $Rh^+$, with blood group A and B and either genotype AA or AS, were observed amongst the study population in the ratio of 1:1.**

**Amongst individuals with characteristic traits combination: AS + IFR + HR + $Rh^+$ and AS + IFL + HR + $Rh^+$, only those with blood group AB were none existent. Those with the characteristic traits combination: AA + IFR + HR + Rh + and AA + IFL + HR + $Rh^+$, were observed amongst the population, irrespective of the blood group (A, B, AB or O). But, individuals with the characteristic traits combination: AA + IFL + HR + $Rh^-$, were observed only amongst the population with blood groups A and O, while individuals with the characteristic traits combination: AA + IFR + HB+ $Rh^+$, were observed only amongst the population with blood groups B and O.**

**Generally, there was near zero computation for individuals with blood group AB as evident in almost all classifications except for those in class AA + IFR + HR + $Rh^+$ and AA + IFL + HR + $Rh^+$ (figures 1 - 6 representing the graphical description of all the results).**

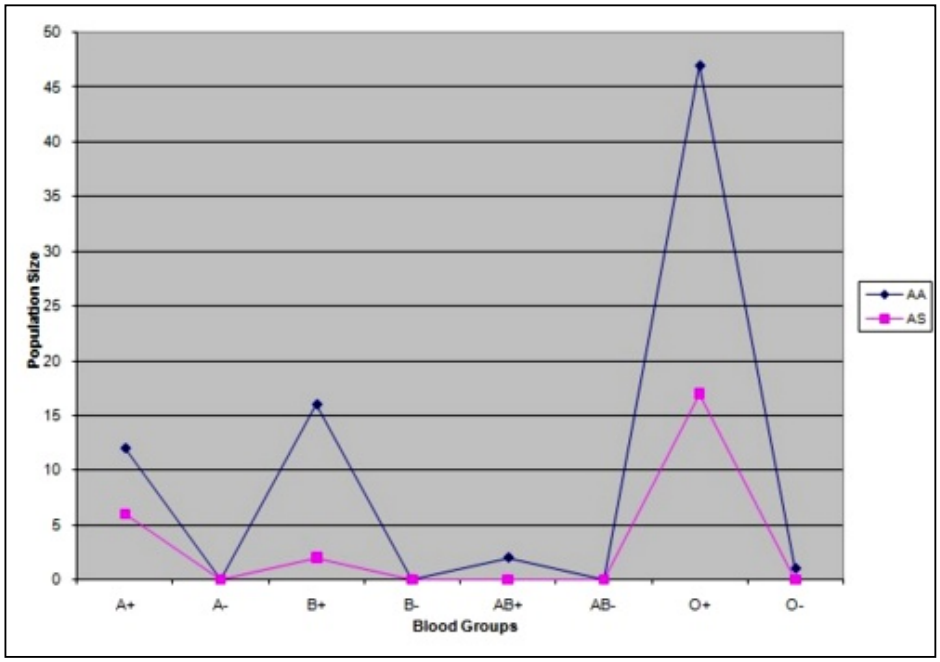


**Figure 1: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFR + HR).**

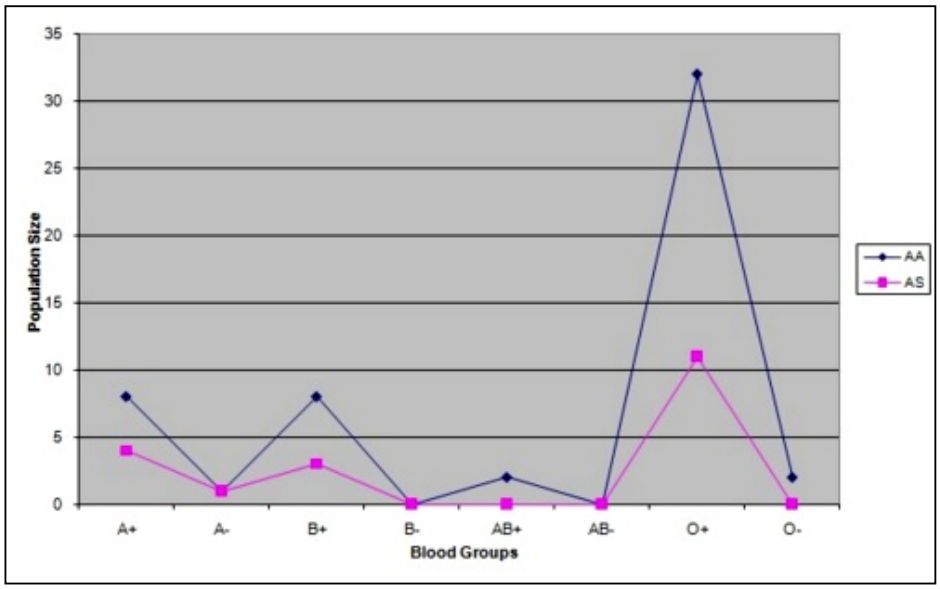


**Figure 2: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFL+HR).**

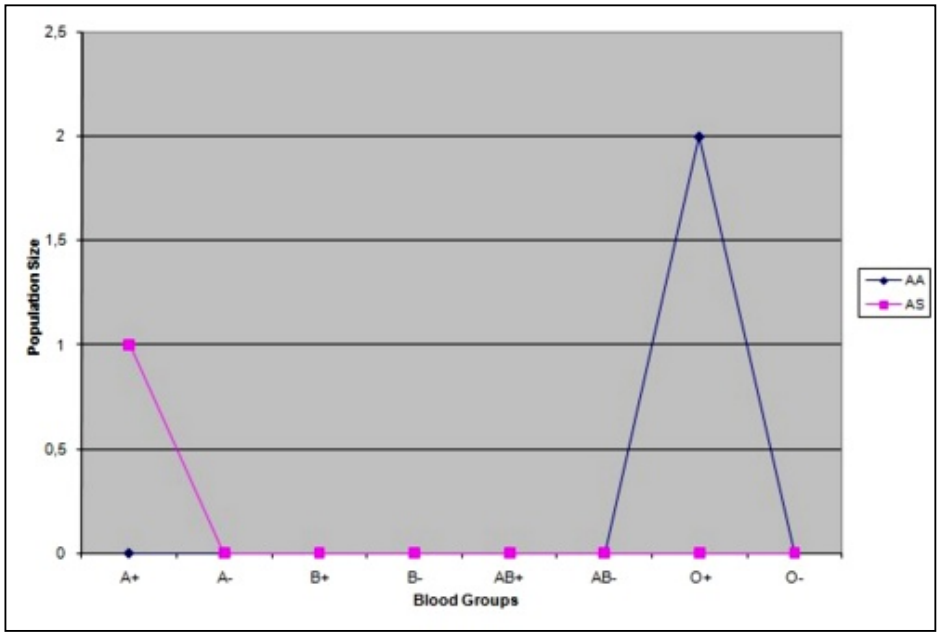


**Figure 3: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFR + HL).**

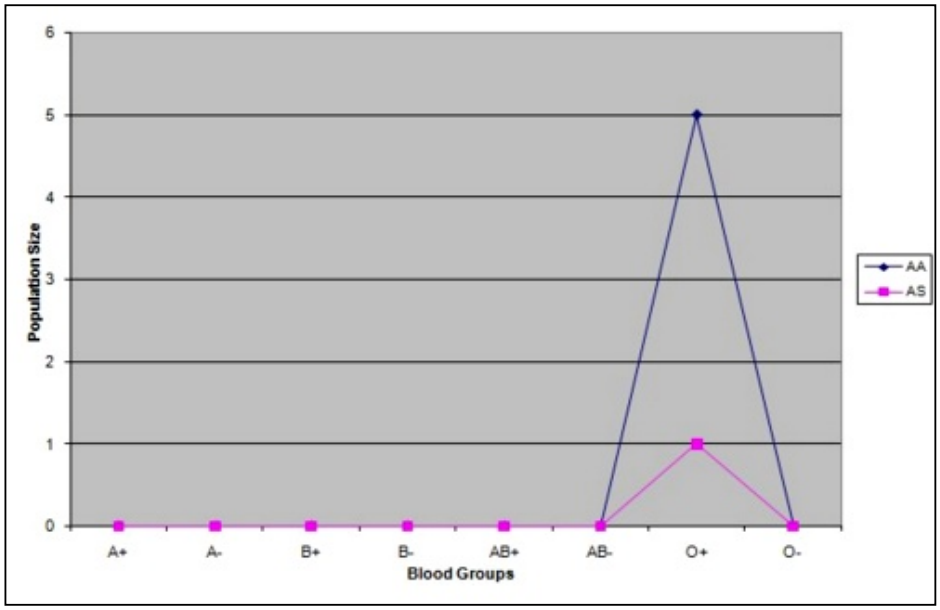


**Figure 4: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFL + HL).**

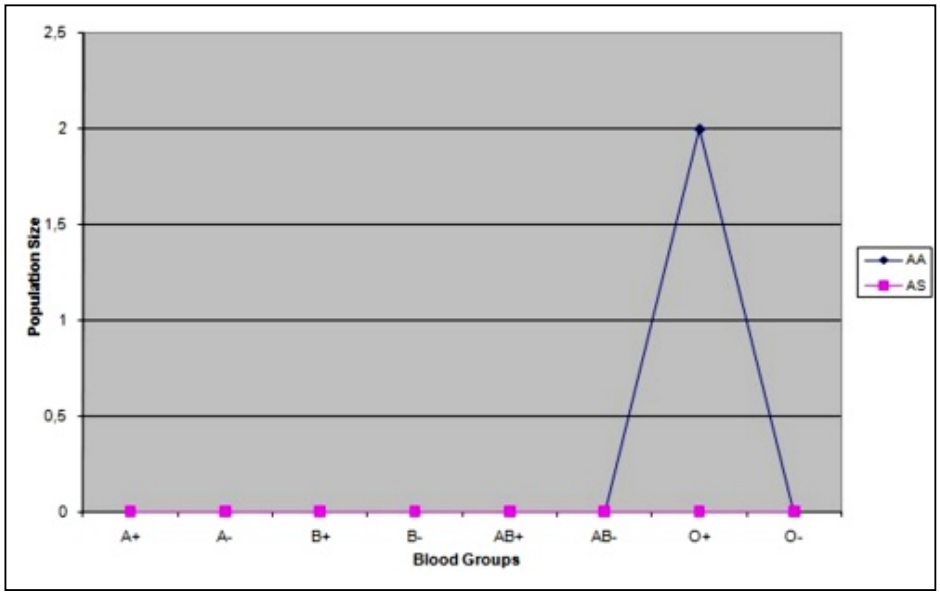


**Figure 5: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFR + HB).**

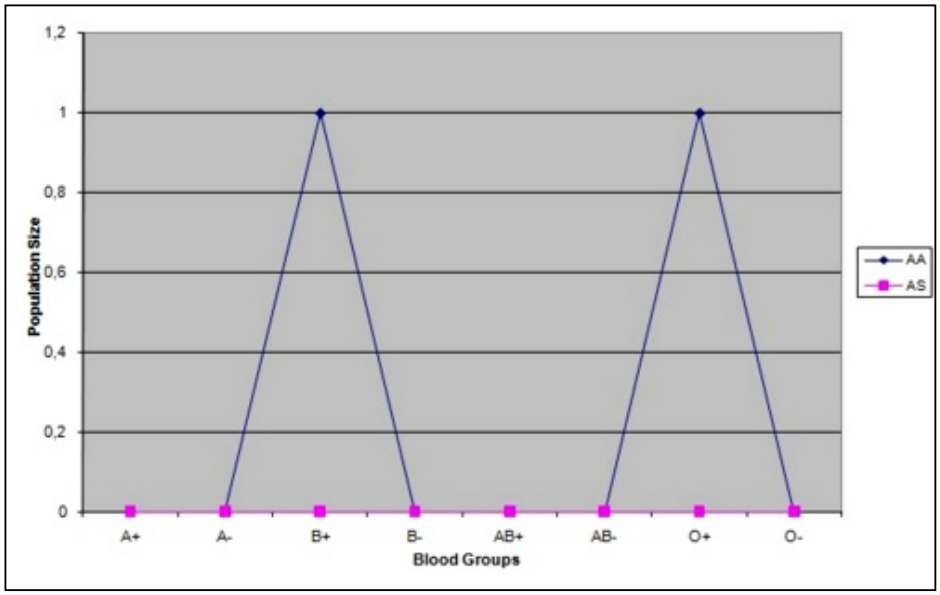


**Figure 6: Individuals with different blood groups and genotype but with the same morphogenetic traits combination (IFL + HB).**

**These findings are in line with the reports by Hardyck and Petrinovich[18] and Wikipedia[19], that left-handedness is less common than right-handedness as about 8 to 15% of people are lefthanded while ambidexterity is exceptionally rare. Again, the findings on the distribution of the ABO blood groups with O being the most common blood type, agrees with those of Seeley et al.[1]; Pramanik and Pramanik[2] and Adeyemo and Soboyejo[20]. Interestingly, Shandilya[21] had acknowledged that the most common blood group is the O positive while Rhodes[22] and Infoplease.com[23] reported that nearly 85% of all human beings have $Rh^-$ positive blood and over 99% of the population of China has the $Rh^+$ blood type respectively.**

**On the distribution of the population based on genotype, the results tallies with the reports by Adeyemo and Soboyejibo[20] who observed a higher incidence of HbAA than HbAS. Previous reports on Nigerians show that the normal haemoglobin (HbAA), ranges from 55 to 75%[7], while the sickle cell trait (HbAS) ranges from 20 to 30%[24].**

**Another aspect of this study was the attempt to classify the population based on a combination of blood type (A, B, AB, O, $Rh^+$ and $Rh^-$), genotype, hand preference (Handedness) and interlocking fingers. From the results, it could be observed that the characteristic traits combinations: AA + IFR + HL+ $Rh^-$; AA + IFL + HL+ $Rh^-$; AA + IFR + HB+ $Rh^-$; AA + IFL + HB+ $Rh^-$; AS + IFR + HR + $Rh^-$; AS + IFR + HL+ $Rh^-$; AS + IFL + HL+ $Rh^-$; AS + IFR + HB+ $Rh^-$and AS + IFL + HB+ $Rh^-$ were none existent and interestingly, classes are all associated with *Rhesus* negative irrespective of the blood group or genotype.**

**Except for the individuals with blood group O and genotype AA, there was also none existence of the characteristic trait's combination: AA + IFR + HR + $Rh^-$; AA + IFR + HL+ $Rh^+$; AA + IFL + HL+ $Rh^+$; AS + IFL + HL+ $Rh^+$; and AS + IFR + HB+ $Rh^+$. On the contrary however, these traits-combinations are associated with *Rhesus* positive, thereby indicating that there is a more likely chance that any individual with these traits-combination, might likely have the O+ blood type and genotype AA.**

**Furthermore, individuals with the characteristic traits combination: AS + IFL + HR + $Rh^-$ and AS + IFR + HL+ $Rh^+$, were observed only amongst those with blood group A and genotype AS in the ratio of 1:1. All the individuals with these trait-combinations have the AS genotype irrespective of the *Rhesus* type, thereby indicating that there is a more likely chance that any individual with this traits-combination, might likely have the blood genotype AS.**

**The characteristic traits combination: AA + IFR + HB+ $Rh^+$, was observed only amongst those with blood group B and genotype AA and this as well, indicates that there is a more likely chance that any individual with this trait-combination might likely have the blood type B positive and genotype AA. On the other hand, it was observed that individuals with the characteristic traits combination: IFL + HB+ $Rh^+$, with blood group A or B and either genotype AA or AS, were in the ratio of 1:1. This indicates that there is a more likely chance that any individual with this traits-combination might likely not have the blood type AB and O irrespective of the genotype (AA or AS).**

**Amongst individuals with the characteristic traits combination: AS + IFR + HR + $Rh^+$ and AS + IFL + HR + $Rh^+$, only those with blood group AB were none existent. This indicates that individuals that might exhibit this traits combination are likely not to have the blood type AB+ and genotype AS. Moreover, the rareness of the AB blood type was again evident in the results of this study, with reference to the near zero representation recorded for individuals with blood group AB in almost all the traits - combination patterns except for AA + IFR + HR + $Rh^+$ and AA + IFL + HR + $Rh^+$. Of course, this indicates that individuals with blood group AB who might be in this category are likely to be *Rhesus* positive and with genotype AA.**

**Another interesting observation is the fact that the traits-combination: AA + IFL + HR + $Rh^-$was observed only amongst the population with the blood groups A and O, while the traits combination: AA + IFR + HB+ $Rh^+$, was observed amongst the population with blood groups B and O. This is an indication that individuals with such traits combination pattern are more likely to have the genotype AA and blood group types of A or O and B or O respectively.**

**Finally, as the findings from this study have shown that the traits-combinations: AA + IFR + HR + Rh + and AA + IFL + HR + $Rh^+$, existed amongst the population irrespective of the blood groups (A, B, AB and O), one can not but suggest that such traits-combinations are likely the most widely distributed amongst the population under study. Indeed, like we had stated earlier[25], it is our believe that a better understanding of these traits combination patterns, might one day serve as a primary emergency clinical tool. Of course the existing association of genetic traits with certain clinical conditions justifies this assertion.**

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**Received June 1, 2009.**
**Published, September 27, 2009**